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Configuring Differentiated Services

NORTEL NETWORKS™

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Preface

This guide describes differentiated services and what you do to start and customize these services on a Nortel Networks router.

Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (see the installation guide that came with your router).
- Connect the router to the network and create a pilot configuration file (see *Quick-Starting Routers*, *Configuring BayStack Remote Access*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Nortel Networks BayRS™ and Site Manager software. For information about upgrading BayRS and Site Manager, see the upgrading guide for your version of BayRS.

Text Conventions

This guide uses the following text conventions:

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: If the command syntax is: **ping** <*ip_address*>, you enter: **ping 192.32.10.12**
bold text	Indicates command names and options and text that you need to enter. Example: Enter **show ip** {**alerts** | **routes**}. Example: Use the **dinfo** command.
braces ({})	Indicate required elements in syntax descriptions where there is more than one option. You must choose only one of the options. Do not type the braces when entering the command. Example: If the command syntax is: **show ip** {**alerts** | **routes**}, you must enter either: **show ip alerts** or **show ip routes**, but not both.
brackets ([ ])	Indicate optional elements in syntax descriptions. Do not type the brackets when entering the command. Example: If the command syntax is: **show ip interfaces** [**-alerts**], you can enter either: **show ip interfaces** or **show ip interfaces -alerts**.
ellipsis points (. . .)	Indicate that you repeat the last element of the command as needed. Example: If the command syntax is: **ethernet/2/1** [<*parameter*> <*value*>] **. . .** , you enter **ethernet/2/1** and as many parameter-value pairs as needed.

italic text	Indicates file and directory names, new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore. Example: If the command syntax is: **show at** <*valid_route*> *valid_route* is one variable and you substitute one value for it.
`screen text`	Indicates system output, for example, prompts and system messages. Example: `Set Trap Monitor Filters`
separator (>)	Shows menu paths. Example: Protocols > IP identifies the IP option on the Protocols menu.
vertical line (|)	Separates choices for command keywords and arguments. Enter only one of the choices. Do not type the vertical line when entering the command. Example: If the command syntax is: **show ip** {**alerts** | **routes**}, you enter either: **show ip alerts** or **show ip routes**, but not both.

Acronyms

This guide uses the following acronyms:

COPS	Common Open Policy Server
DHCP	Dynamic Host Configuration Protocol
DNS	domain name server
GUI	graphical user interface
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
ISO	International Organization for Standardization
LDAP	Lightweight Directory Access Protocol
TCP	Transmission Control Protocol
URL	uniform resource locator

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Chapter 1
Differentiated Services Overview

Differentiated services is a network architecture that lets service providers and enterprise network environments offer varied levels of service for different types of data traffic. Instead of using the “best-effort” service model to ensure data delivery, differentiated services lets you designate a specific level of performance on a packet-by-packet basis. If you have applications that require high performance and reliable service, such as voice and video over IP, you can use differentiated services to give preferential treatment to this data over other traffic.

For each packet, there is a differentiated services field in the packet header that you can mark for specific service. For IP packets, this is called the *DS field*. The DS field has a specific value that defines how the packet is treated as it travels through the network.

Differentiated services is scalable, making it ideal for large networks. Edge devices, like Nortel Networks routers, classify much of the data, leaving less of the processing for the core of the network. In addition, the services can aggregate traffic for more efficient transmission.

Implementing Differentiated Services

In any differentiated services network, the edge router is responsible for filtering and marking data packets for service; however, there are two different methods for configuring filters on the edge router.

You can install filters using one of two methods:

- Dynamically install them by a server called the bandwidth broker, which communicates with the router using the Common Open Policy Server (COPS) protocol. Trigger and flow filters are then automatically installed on the router.

- Manually configure them on the edge router.

  You can create filters that instruct the router to mark specific packets for special service throughout the network. If you manually configure filters, there is no need for a bandwidth broker or policy server.

Implementing a differentiated depends on your specific network requirements. If you implement differentiated services with a bandwidth broker, you have more flexibility and control over your network, but you have the cost and effort of maintaining a server. Conversely, if you manually configuring filters, this requires a lot of work because you must configure each router separately, but you do not have the added cost of maintaining a server.

Components of a Differentiated Services Network

The following devices comprise a differentiated services network:

- Host

  Resides at the sending and receiving point in the network. The host is the device that requests service from the network.

- Bandwidth Broker

  The bandwidth broker typically resides in the ISP or enterprise network. Its primary function is to act as a resource manager, keeping records of all the reserved data flows and filters and managing bandwidth allocation.

  The bandwidth broker installs trigger and flow filters on the edge router. These filters tell the router how to process incoming packets. The trigger filter detects the beginning of a traffic flow and notifies the bandwidth broker. The flow filter identifies packets that belong to a specific data flow and designates how packets that match the filter should be marked. The edge device and the bandwidth broker communicate using the COPS protocol.

  The bandwidth broker may also be called the COPS server because COPS is the protocol used for communication between the broker and the edge router.

  Not all differentiated services networks have a bandwidth broker. If no bandwidth broker exists, you must configure filters on the edge device.

- Policy server

  The policy server resides inside the ISP or enterprise network. It provides policy admission control, which administrates network services and user authentication functions. The policy server monitors which data flows are assigned to a user and whether an application should have network access. In addition, the policy server polices data flows so it can limit the amount of high-priority traffic in the network. This prevents network resources from becoming overburdened.

  In some networks, the bandwidth broker is the same device as the policy server; however, they can be different devices.

  Not all differentiated services networks use a policy server.

- Edge router

  The edge router resides at the edge of the network. Its function is to classify data flows and mark them by setting the DS field in the IP header. The DS field designates a specific type of service to each packet and instructs the network how to process the packet.

- Core network device

  The core network device, which is typically a high-performance router, resides in the ISP or enterprise network. It routes data along the appropriate path through the network. This router cannot classify packets itself.

- Server Manager

  The server manager, which resides outside the network, sets up video conferences. The server manager sometimes acts as the intermediary between the host and the bandwidth broker, passing on the host's requests to the bandwidth broker. The server manager is not a required part of a differentiated services network.

Figure 1-1 shows a differentiated services network that includes a server manager and a bandwidth broker. If you manually configure filters, the bandwidth broker and server manager would not be included.

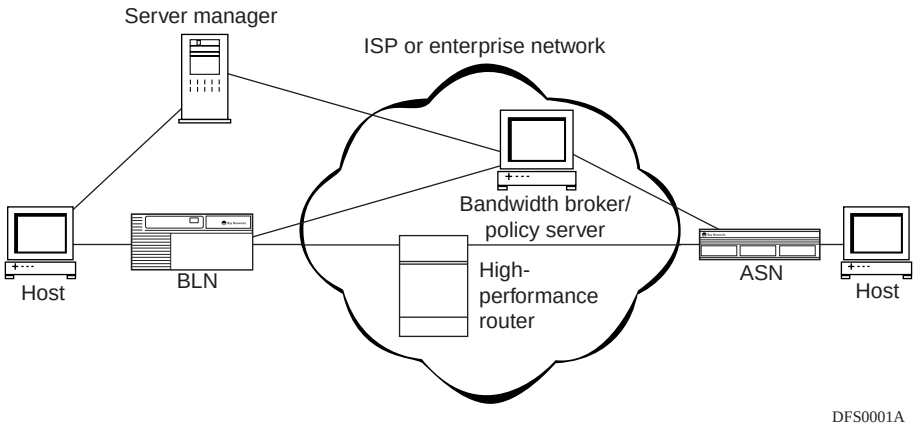


Figure 1-1. Differentiated Services Network

Communicating with the Bandwidth Broker

If your differentiated services network uses a bandwidth broker, the router uses the COPS protocol to communicate with the bandwidth broker. COPS enables the exchange of policy information between the bandwidth broker and its clients.

The router is the COPS client. The COPS client uses the Transmission Control Protocol (TCP) to communicate with the bandwidth broker. The COPS client can connect to only one server at a time, choosing the server from list of servers that you define.

When the router requests a filter from the bandwidth broker, the bandwidth broker responds with its own request to perform one or more of the following actions:

- Install a new filter.
- Update an existing filter.
- Disable or enable an existing filter.
- Delete an existing filter.

For each request, the differentiated services application on the router takes the necessary action and then sends an acknowledgment back to the bandwidth broker. Note that the bandwidth broker can also send unsolicited requests.

If an interface on the router becomes inactive or terminates, the differentiated services application deletes all filters from that interface. After the interface recovers, the router needs to request the filters from the bandwidth broker again. If the connection to the bandwidth broker is temporarily lost, the COPS client software attempts to reconnect to the server. In this case, the router does not delete the filters.

The bandwidth broker assigns an ID to each filter before installing it on the router. The bandwidth broker can then change an installed filter based on that ID. If the bandwidth broker requests an update or removal of a nonexistent filter, the router ignores the request and sends an error message to the bandwidth broker. You can view the filters installed by the bandwidth broker using the router's traffic filters feature, but you cannot modify them.

Figure 1-2 shows the Nortel Networks bandwidth broker architecture.

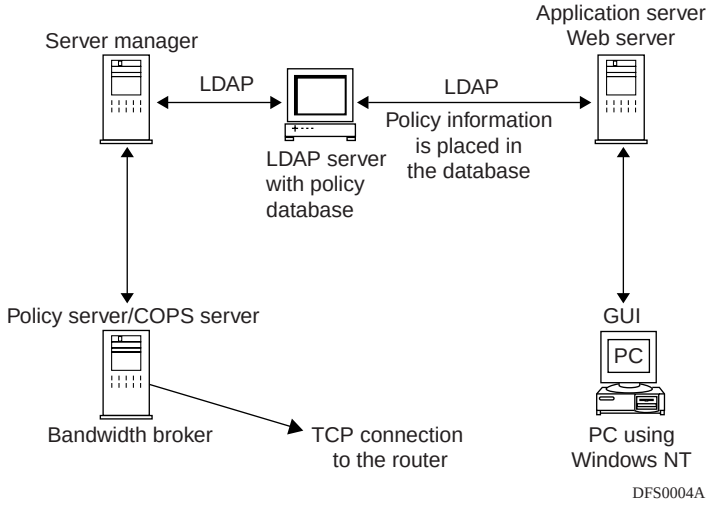


Figure 1-2. Architecture of the Bandwidth Broker

Marking Packets for Specific Services

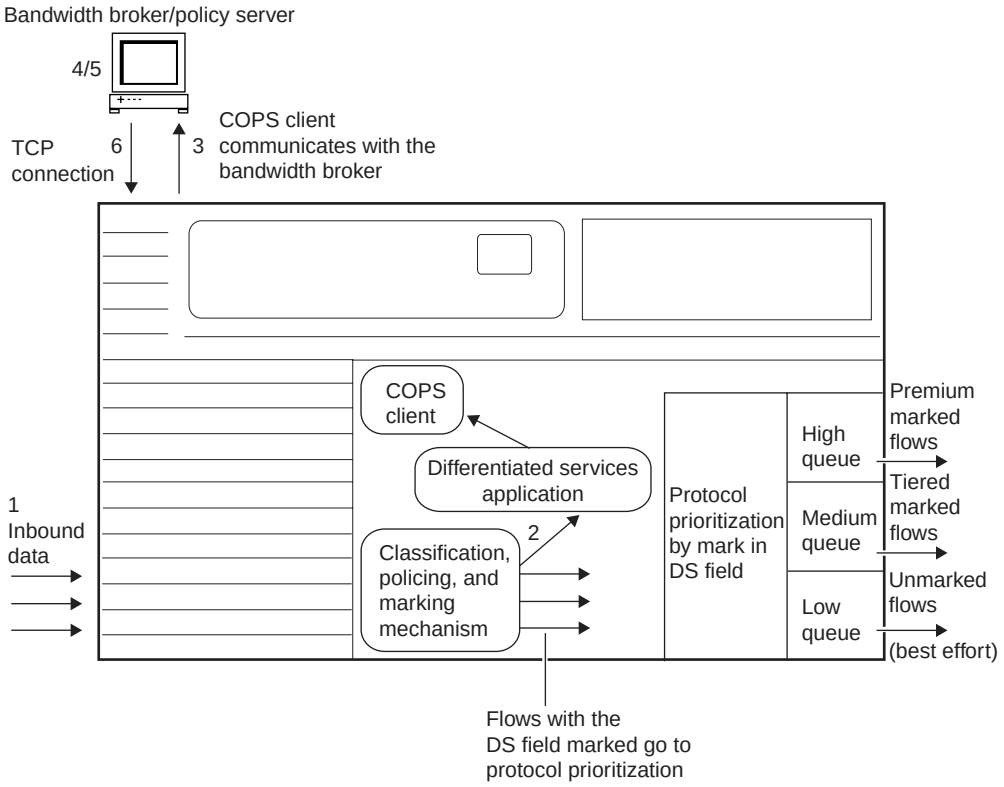
A packet's assigned level of service determines whether it receives preferential treatment as it travels through the network. The DS field has a specific value that determines the service.

If the router communicates with a bandwidth broker, the process of installing filters and marking packets is as follows:

1. The edge router contacts the bandwidth broker with a configuration request. This happens automatically as part of the router's normal differentiated services activity for each differentiated services interface.
2. The bandwidth broker responds by downloading a set of trigger and flow filters from its database to the edge router.
3. When a packet arrives at a router's differentiated services interface, the router checks its trigger filter and flow filters, if any are installed, to see if the packet matches either filter's criteria. If the packet matches the trigger filter's criteria, the router sends a message to the bandwidth broker. (For the purposes of this explanation, we will assume that the packet did not match any previously installed flow filter.)
4. After the bandwidth broker receives a message from the router, it responds, possibly with its own request to install additional filters.

   The router may or may not accept the additional filters because it may have a limit on the number of filters it can handle, or the filter is misconfigured with an action that is unknown to the router. If the bandwidth broker does install additional filters, they are added to the filter table of the differentiated services interface.
5. Packets that arrive on that interface that match the flow filter criteria are marked by the differentiated services application with a DS-field pattern specified by the filter. The value in the DS field determines whether the packet is sent to a high-priority data queue for preferential treatment. This is how each packet gets marked or "differentiated" for a specific type of service.
6. After a packet is marked, it is sent to the core network device where, depending on the marking, the packet receives preferential treatment as it is routed through the network and on to the destination host.

Figure 1-3 shows the Nortel Networks differentiated services architecture and how the router marks a packet.



1. Router receives data.

2. There is a trigger filter match and the differentiated services application is notified.

3. Router sends message to bandwidth broker, which includes the trigger filter ID and part of the original data packet.

4. Bandwidth broker associates traffic with a level of service. The dataflow passes policy admission control.

5. Bandwidth broker associates the level of service with bandwidth resources. The dataflow passes bandwidth admission control.

6. The bandwidth broker installs a flow filter on the router.

DFS0005A

Figure 1-3. Nortel Networks Differentiated Services Architecture

URL Filters

The router can filter and mark Hypertext Transfer Protocol (HTTP) traffic based on uniform resource locator (URL) strings. For the router to use an URL filter, whether it is installed by the bandwidth broker or configured manually, it must contain the URL string and optionally, any of the following information:

- Source IP address
- Destination IP address
- Destination port (the default port is 80)

Although only the URL string is required, for efficient data transmission, it is useful to also include one of these other filter criteria.

After the trigger and flow filters are configured on the router, the router can mark inbound HTTP traffic for transmission through the network. If the router receives data that matches a URL filter, the router installs another filter, called the *dynamic filter*, on the next-hop interface, which is an interface on this same router. This filter is available for the duration of the HTTP session. This dynamic filter is deleted if there is no data activity during the time period specified by the URL idle out timer. The original URL filter remains installed on the router.

For more information about the URL idle out timer, see the URL Idle Out Timer parameter description on page A-4.

Note: Even if you configure URL filters manually (static configuration), the differentiated services application uses COPS to install the dynamic filter. URL filters are the only filters that create these dynamic filters.

You must configure differentiated services on all possible next-hop interfaces on the router, or at least all next-hop interfaces where the HTTP servers might reside. Otherwise, the router will not be able to mark the return packets.

Chapter 2
Starting Differentiated Services

The quickest way to configure differentiated services on the router is to enable it with the default configuration that Nortel Networks software supplies. This configuration uses all available default values for the interface and COPS parameters. You will need to supply values only for parameters that do not have default values.

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Planning for a Differentiated Services Network

This guide primarily explains how to configure a Nortel Networks router as a differentiated services edge device.

For the router to successfully operate in a differentiated services network, you must obtain the following information prior to configuring it:

- The IP address of the bandwidth broker.
- The client IP Address and ID of the router. Provide this information to the administrator configuring the bandwidth broker.

Starting the Site Manager Configuration Tool

Before configuring differentiated services, see *Configuring and Managing Routers with Site Manager* for instructions on how to use the Configuration Manager for configuration tasks. This guide also describes generally how to create and modify a configuration.

Preparing a Configuration File

Before starting differentiated services, you must create and save a configuration file with at least one IP interface. The physical interface can be any LAN port, for example, Ethernet or token ring.

For information about creating a configuration file, see *Quick-Starting Routers*.

To add differentiated services to a configuration file, first open the file by completing the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the main Site Manager window, choose **Tools**.	The Tools menu opens.
2. Choose **Configuration Manager**.	The Configuration Manager window opens.
3. Choose **Local File, Remote File, or Dynamic**.	Site Manager prompts you for the configuration file you want to open.
4. Select the file and click on **OK**.	You return to the Configuration Manager window, which displays the router slots and their associated modules.

Enabling Differentiated Services

To enable a differentiated services interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on an IP interface connector.	The Add Circuit window opens.
2. Accept the default circuit name or enter a new name, then click on **OK**.	The Select Protocols window opens.
3. Scroll through the list of protocols, and choose **DiffServ**, then click on **OK**.	The IP Configuration window opens.
4. Enter the router's IP address in the **IP Address** field, then click on **OK**. See *Configuring IP, ARP, RIP, and OSPF Services* for a parameter description.	The DiffServ Interface List window opens. The interface is now enabled.
5. Click on **Done**.	You return to the Configuration Manager window.

Choosing A Filter Mechanism

In addition to enabling a differentiated services interface, you must select a mechanism for installing filters on the router. The router uses filters to determine which packets it should mark for special treatment through the network. You can either enable the COPS protocol or manually configure filters.

Note: The router does not allow IP traffic filters on a differentiated services interface. If you add differentiated services to an interface that already has IP traffic filters configured, the router will remove them.

Go to one of the following sections to choose a filter mechanism:

- Enabling COPS on page 2-4
- Enabling Static Filters on page 2-5

Enabling COPS

If the router is receiving filters from a bandwidth broker, you need to enable COPS so the router can communicate with the bandwidth broker.

To enable COPS, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the DiffServ Interface List window, set the **Config Type** parameter to **COPS**. Click on **Help** or see the parameter description on page A-4.	Site Manager displays a message informing you that the static filters will be deleted and asks if you want to continue.
2. Click on **OK**.	You return to the DiffServ Interface List window.
3. Click on **Apply**.	A message prompts: `Static filters will be deleted. Do you want to continue?`
4. Click on **OK**.	You return to the DiffServ Interface List window.
5. Click on **COPS Global**.	The Edit COPS Global Parameters window opens.
6. Set the following parameters: • **Client IP Address** • **Client ID** Click on **Help** or see the parameter descriptions beginning on page A-8.	
7. Click on **OK**.	You return to the DiffServ Interface List window.
8. Click on **COPS Servers**	The COPS Server List window opens.
9. Click on **Add**.	The COPS Server Record window opens.
10. Set the **IP Address** parameter. Click on **Help** or see the parameter description on page A-16.	
11. Click on **OK**.	You return to the COPS Server List window, with the server entry listed.
12. Click on **Done**.	You return to the DiffServ Interface List.
13. Click on **Done**.	You return to the Configuration Manager window.

Enabling Static Filters

If your network does not use a bandwidth broker, you need to manually configure filters on the router.

When you create traffic filters, it is important to understand the difference between a traffic *filter template* and an actual traffic *filter*. A filter template is a reusable, predefined specification for a traffic filter. You create an actual traffic filter when you apply a filter template to a configured router interface. You can apply a single template to as many interfaces as you want.

Each template must contain filter criteria and filter actions (log, drop, accept, set DS field, set DS police). The actions are performed on the filtered packets.

Note: Log is the only action that you can combine with other actions. For example, you cannot combine Set DS Field and Set DS Police for one filter.

Creating a Filter Template

To configure a differentiated services filter template, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Select the interface you want to modify, and click on **Traffic Filt**.	The DiffServ Static Filters window opens.
6. Click on **Template**.	The Filter Template Management window opens.
7. Click on **Create**.	The Create DiffServ Template window opens.
8. Enter a name for the template in the **Filter Name** field.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
9. Choose **Criteria**.	The Criteria menu opens.
10. Choose **Add**.	The Add menu opens.
11. Add one or more filter criteria.	
12. Choose **Action**.	The Action menu opens.
13. Choose **Add**.	The Add menu opens.
14. To select the DS field as the filter action, choose **DiffServ Set Field** and set a value for the DS Field, 00000000 to 11111111. See “DS Field” on page A-18 for more information.	
15. To select the DiffServ Police as the filter action, choose **DiffServ Set Police** and set the following parameters: • **Token Bucket Rate (Kbps)** • **Token Bucket Size (Bits)** • **Inprofile Marking** • **Out of Profile Marking** Click on **Help** or see the parameter descriptions beginning on page A-20. Accept the default values for the other parameters.	
16. Click on **Save**.	You return to the Create DiffServ Template window.
17. Click on **OK.**	You return to the Filter Template Management window.
18. Click on **Done**.	You return to the DiffServ Static Filters window.
19. Apply the filter template according to the instructions in the next table.	

Applying the Template to a Filter

After you create your differentiated services filter template, you need to create a filter by applying the template to a differentiated services interface.

To apply a filter template, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the DiffServ Static Filters window, click on **Create**.	The Create Filter window opens.
2. Enter a name for the filter in the **Filter Name** field.	
3. Select the differentiated services interface that should use this filter in the Interfaces list.	
4. Select a template in the Templates list.	
5. Click on **OK**	You return to the DiffServ Static Filters window. Site Manager displays the filter name and its interface in the scroll list.
6. Click on **Done** until you return to the Configuration Manager window.	

Configuring Filters for HTTP Packets

To modify a filter to include URLs, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. See "Creating a Filter Template" on page 2-5 and follow steps 1 through 5 in the table.	
2. Click on **Edit**.	The Edit DiffServ Filters window opens.
3. Choose **Criteria**.	The Criteria menu opens.
4. Choose **Add**.	The Add menu opens.
5. Choose **Add URL**.	The Add URL window opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
6. Set the **URL** parameter. Click on **Help** or see the parameter description on page A-23.	
7. Click on **OK.**	You return to the Edit DiffServ Filters window.
8. Click on **OK**.	You return to the DiffServ Static Filters window.
9. Click on **Done** until you return to the Configuration Manager window.	

You must always associate a filter criteria with a filter action. This ensures that the router uses the URL criterion with the appropriate differentiated services action, for example, Set DS Field, to determine how to mark packets.

For detailed information about creating filters, see *Configuring Traffic Filters and Protocol Prioritization*.

What To Do Next

Now that you have completed the steps in this chapter, differentiated services should be operating on at least one interface. To customize the differentiated services configuration, go to Chapter 3, “Customizing Differentiated Services.”

Chapter 3
Customizing Differentiated Services

When you enable differentiated services, default values are in effect for all parameters. Depending on your network requirements, you may want to change these values.

This chapter describes how to customize your differentiated services configuration and includes the following topics:

Topic	Page
Adding a Differentiated Services Interface	3-2
Modifying a Differentiated Services Interface	3-3
Disabling and Reenabling Differentiated Services Interfaces	3-4
Deleting Differentiated Services Interfaces	3-5
Adding COPS Servers	3-6
Modifying COPS Global Parameters	3-7
Modifying the COPS Server Record	3-8
Disabling and Reenabling a COPS Server	3-11
Deleting a COPS Server	3-11
Disabling and Reenabling COPS on the Router	3-12
Deleting COPS from the Router	3-12
Modifying Traffic Filters	3-13

Adding a Differentiated Services Interface

To add a differentiated services interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Click on **Add**.	The DiffServ Interface Record window opens.
6. Click on **Values**.	The Values Selection window opens.
7. Select an IP interface from the list, then click on **OK**.	Site Manager enters this address for the IP Address parameter.
8. Click on **OK**.	You return to the DiffServ Interface List window.
9. Click on **Done**.	You return to the Configuration Manager window.

Modifying a Differentiated Services Interface

You can modify the configuration type of a differentiated services interface, specify which debug messages for an interface are stored in the router's events log, and specify an idle timer for URL filters.

To modify a differentiated services interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Select the interface you want to modify.	
6. Set the following parameters: • **Config Type** • **Debug Log Mask (hex)** • **URL Idle Out Timer** Click on **Help** or see the parameter descriptions beginning on page A-3.	
7. Click on **Done**.	You return to the Configuration Manager window.

Disabling and Reenabling Differentiated Services Interfaces

After you create a differentiated services interface, by default it is enabled. You can disable and reenable a single interface or all interfaces at any time.

Disabling and Reenabling a Single Interface

To disable or reenable a single interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Select the interface you want to disable or reenable.	
6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-3.	
7. Click on **Done**.	You return to the Configuration Manager window.

Disabling and Reenabling All Interfaces

To globally disable or reenable differentiated services interfaces, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Global**.	The Edit DiffServ Global Parameters window opens.
5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-6.	
6. Click on **Done**.	You return to the Configuration Manager window.

Deleting Differentiated Services Interfaces

You can delete a single interface or all interfaces from the router.

Deleting a Single Interface

To delete a single interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Select the interface you want to disable or reenable, and click on **Delete**.	Site Manager removes the interface from the list.
6. Click on **Done**.	You return to the Configuration Manager window.

Deleting All Interfaces

To globally delete differentiated services interfaces, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Delete**.	A confirmation window prompts: `Do you REALLY want to delete DiffServ?`
5. Click on **OK**.	You return to the Configuration Manager window.

Adding COPS Servers

To add COPS servers that the router can communicate with, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Servers**.	The COPS Server List window opens
5. Click on Add.	The COPS Server Record window opens.
6. Set the **IP Address** parameter. Click on **Help** or see the parameter description on page A-16.	

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
7. Click on **OK**.	You return to the COPS Server List window. Site Manager adds the new server to the server list.
8. Click on **Done**.	You return to the Configuration Manager window.

Modifying COPS Global Parameters

In most cases, you do not need to modify the solo slot mask, the COPS client's IP address, or the client ID after you initially configure them. However, you may modify these parameters.

To modify the client's address and ID, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Global**.	The Edit COPS Global Parameters window opens.
5. Set the following parameters: • **Solo Slot Mask** • **Client IP Address** • **Client ID** Click on **Help** or see the parameter descriptions beginning on page A-8.	
6. Click on **OK**.	You return to the Configuration Manager window.

Modifying the COPS Server Record

The following sections describe how to modify the COPS server record.

Prioritizing COPS Servers

You can prioritize the available COPS servers so that the router tries connecting to one server before trying another. The router can connect to only one server at a time.

To assign a priority number to each server, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Servers**.	The COPS Server List window opens.
5. Set the **Priority** parameter. Click on **Help** or see the parameter description on page A-10.	
6. Click on **Apply**.	
7. Click on **Done**.	You return to the Configuration Manager window.

Modifying the COPS Connection

The connection to the COPS server is established at two different levels, the COPS layer and the TCP layer. The COPS application on the router is a TCP client.

At the COPS level, you can customize how the router connects to a COPS server, for example, defining how often the router retries a connection and how long the router keeps the connection active.

To customize how the router connects to a COPS server, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Servers**.	The COPS Server List window opens.
5. Set the following parameters: • **Connection Retry Period** • **Connection Retry Count** • **KeepAlive Time Period** • **Report Time Period** Click on **Help** or see the parameter descriptions beginning on page A-10.	
6. Click on **Apply**.	
7. Click on **Done**.	You return to the Configuration Manager window.

Maintaining the TCP Connection to the Server

The router communicates to the COPS server across a TCP connection. To keep the connection established, even when there is no data being transmitted, you can configure keepalive timers and retry counts to maintain the connection.

To modify the keepalive parameters that maintain the TCP connection, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
4. Choose **COPS Servers**.	The COPS Server List window opens.
5. Set the following parameters: • **TCP KeepAlive Interval** • **TCP KeepAlive RTO** • **TCP KeepAlive Max Retry Cnt** Click on **Help** or see the parameter descriptions beginning on page A-10.	
6. Click on **Apply**.	
7. Click on **Done**.	You return to the Configuration Manager window.

Changing the Remote TCP Port

If the bandwidth broker application operates on a different port than the default, which is the defined COPS standard, you can specify a different port. In most cases, however, you can use the default port.

To modify the remote TCP port, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Servers**.	The COPS Server List window opens.
5. Set the **Remote TCP Port** parameter. Click on **Help** or see the parameter descriptions beginning on page A-14.	
6. Click on **Apply**.	
7. Click on **Done**.	You return to the Configuration Manager window.

Disabling and Reenabling a COPS Server

To disable and reenable a single COPS server, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Servers**.	The COPS Server List window opens.
5. Select the server entry you want to disable or reenable.	
6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-10.	
7. Click on **Done**.	You return to the Configuration Manager window.

Deleting a COPS Server

To delete a single server entry from the server list, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Servers**.	The COPS Server List window opens.
5. Select the server entry you want to delete, then click on **Delete**.	Site Manager removes the entry.
6. Click on **Done**.	You return to the Configuration Manager window.

Disabling and Reenabling COPS on the Router

To disable and reenable all COPS servers, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Global**.	The Edit COPS Global Parameters window opens.
5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-7.	
6. Click on **OK**.	You return to the Configuration Manager window.

Deleting COPS from the Router

To delete COPS functionality from the router, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **Global Protocols**.	The Global Protocols menu opens.
3. Choose **COPS Client**.	The COPS Client menu opens.
4. Choose **COPS Delete**.	A confirmation window prompts: `Do you REALLY want to delete COPS?`
5. Click on **OK**.	You return to the Configuration Manager window.

Modifying Traffic Filters

If you selected static for an interface's configuration type, you configured traffic filters because filters are not downloaded from a bandwidth broker.

Note that unlike standard IP traffic filters, only the following actions are allowed for differentiated services traffic filters:

- Log -- For every packet that matches the filter entry, the router enters a message in the Events log. You can specify this action together with other actions.
- Drop -- The router does not route any packet that matches the filter criteria.
- Accept -- The router forwards a packet without marking it.
- DiffServ Set Field -- The router sets the DS byte in the IP header for all packets that match the filter criteria.
- DiffServ Set Police -- The router monitors the packet flow and determines if that packet is in or out of the profile. If the packet fits the profile, the router sets the DS byte.

Another feature unique to differentiated services filters is that you can use URLs as filter criteria, which enables the router to mark HTTP packets.

DS Field and DS Police Traffic Filters

These procedures assume that you have created a filter template and applied it to a filter.

To modify a filter that includes DS Field or DS Police action, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.

(continued)

Site Manager Procedure *(continued)*	
You do this	**System responds**
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Select the interface you want to modify, and click on **Traffic Filt**.	The DiffServ Static Filters window opens.
6. Select the filter you want to edit and click on **Edit**.	The Edit DiffServ Filters window opens.
7. To change the DS field entry, choose **Action** > **Edit DS Field**.	The DS Field window opens.
8. To modify the DS Police action, choose **Action > Edit DS Police** and set the following parameters: • **Token Bucket Rate (Kbps)** • **Token Bucket Size (Bits)** • **MIN Policed (Bytes)** • **MAX Policed (Bytes)** • **Inprofile Marking** • **Inprofile Behavior** • **Out of Profile Marking** • **Out of Profile Behavior** Click on Help or see the parameter descriptions beginning on page A-20.	
9. Click on **Save.**	You return to the Edit DiffServ Filters window.
10. Click on **OK**.	You return to the DiffServ Static Filters window.
11. Click on **Done** until you return to the Configuration Manager window.	

URL Filters

These procedures assume that you have created a filter template and applied it to a filter.

To modify a filter that includes a URL as a criterion, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, choose **Protocols**.	The Protocols menu opens.
2. Choose **IP**.	The IP menu opens.
3. Choose **DiffServ**.	The DiffServ menu opens.
4. Choose **Interfaces**.	The DiffServ Interface List window opens.
5. Select the interface you want to modify, and click on **Traffic Filt**.	The DiffServ Static Filters window opens.
6. Select the filter you want to edit and click on **Edit**.	The Edit DiffServ Filters window opens.
7. Select a URL and click on **Modify**.	The Edit URL window opens.
8. Make any modifications, then click on **OK**.	You return to the Edit DiffServ Filters window.
9. Click on **OK**.	You return to the DiffServ Static Filters window.
10. Click on **Done** until you return to the Configuration Manager window.	

For general information about how to create traffic filters, see *Configuring Traffic Filters and Protocol Prioritization*.

Appendix A
Site Manager Parameters

These topics define differentiated services parameters:

Topic	Page
Interface List Parameters	A-2
Interface Record Parameter	A-5
Differentiated Services Global Parameter	A-6
COPS Global Parameters	A-7
COPS Server List Parameters	A-9
COPS Server Record Parameters	A-15
Static Traffic Filter Parameters	A-16

For each parameter, this appendix provides the following information:

- Parameter name
- Configuration Manager menu path
- Default setting
- Valid parameter options
- Parameter function
- Instructions for setting the parameter
- Management information base (MIB) object ID

The Technician Interface allows you to modify attributes by issuing **set** and **commit** commands with the MIB Object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, see *Using Technician Interface Software*.

Caution: The Technician Interface does not verify attribute values you enter. Entering an invalid value can corrupt your configuration.

Interface List Parameters

The DiffServ Interface List window (Figure A-1) contains the parameters for the differentiated services interfaces. These parameters let you enable an interface and determine its configuration type.

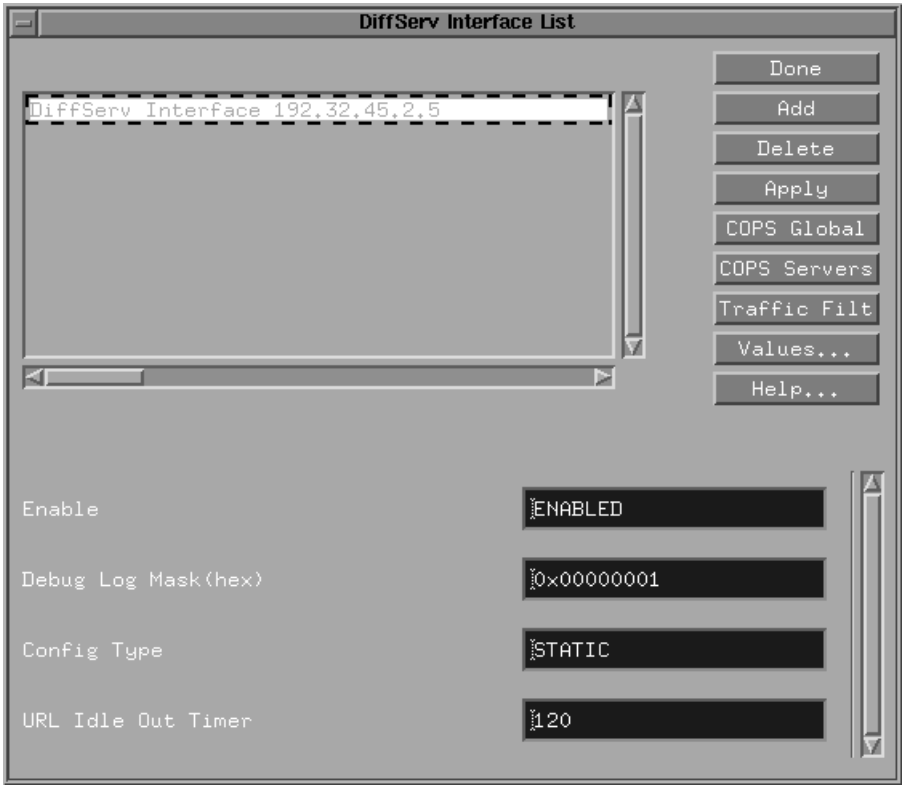

Figure A-1. DiffServ Interface List Window

Parameter: Enable

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces

Default: Enabled

Options: Enabled │ Disabled

Function: Enables or disables differentiated services on this interface.

Instructions: After you configure a differentiated services interface, this parameter is enabled by default. To disable differentiated services on this interface without deleting it, select Disabled.

MIB Object ID: 1.3.6.1.4.1.18.3.5.26.2.1.2

Parameter: Debug Log Mask (hex)

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces

Default: 0x00000001

Options: Filter Maintenance │ Interaction with COPS │ Trigger Events │ IP Interaction │ Extra Debugging

Function: Specifies which event messages the router should include in the event log.

Instructions: Select one or more event messages that you want to include in the log. To log events such as when a filter is added, deleted, enabled, or disabled, select Filter Maintenance. To log when a packet matches a trigger filter criterion and is sent to the server, select Trigger Events. The other options are for debugging. Site Manager fills in the appropriate hex value for the options you have chosen.

MIB Object ID: 1.3.6.1.4.1.18.3.5.26.2.1.6

Parameter: Config Type

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces

Default: Static

Options: Static | COPS

Function: Indicates the configuration type for this interface. The configuration type defines whether the interface uses manually configured filters or filters installed by the bandwidth broker.

Instructions: Select the appropriate configuration type:

Static -- Select this option to manually configure filters. These filters identify packets for specific data flows and define the actions performed on each packet.

COPS -- Select this option to use the Common Open Policy Server (COPS) protocol to request flow filters from the bandwidth broker. Using COPS, the flow filters are already available from the bandwidth broker and are downloaded to the router upon request.

MIB Object ID: 1.3.6.1.4.1.18.3.5.26.2.1.7

Parameter: URL Idle Out Timer

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces

Default: 120

Options: 1 to 0x7fffffff seconds

Function: Specifies the number of seconds that the router waits before a dynamic URL filter on the next-hop interface is deleted.

Instructions: Specify a value for the idle out time period.

MIB Object ID: 1.3.6.1.4.1.18.3.5.26.2.1.8

Interface Record Parameter

The DiffServ Interface Record window (Figure A-2) contains the IP Address parameter for the differentiated services interface. This parameter lets you specify a configured IP address as a differentiated services interface.

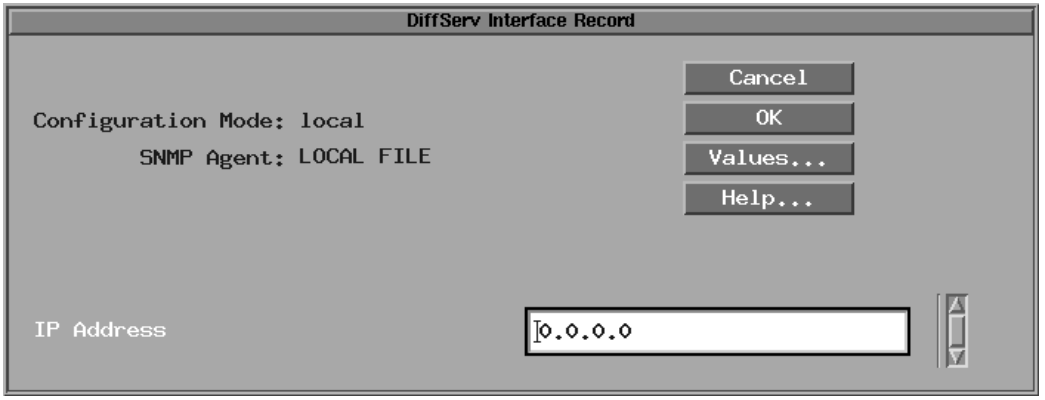

Figure A-2. DiffServ Interface Record Window

Parameter: IP Address

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Add**

Default: None

Options: An existing IP address on the router

Function: Identifies a differentiated services interface on the router.

Instructions: Enter the IP address of the differentiated services interface.

MIB Object ID: Not Applicable

Differentiated Services Global Parameter

The Edit DiffServ Global Parameters window (Figure A-3) contains the Enable parameter, which lets you disable and reenable all differentiated service interfaces on the router.

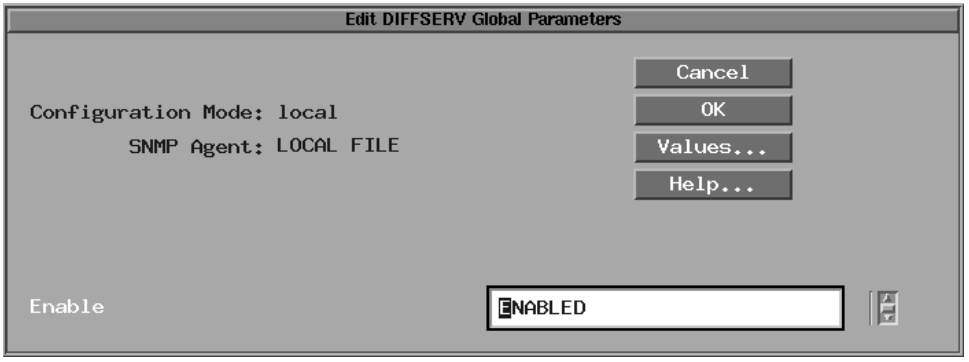

Figure A-3. Edit DiffServ Global Parameters Window

Parameter: Enable

Path: Configuration Manager > Protocols > IP > DiffServ > Global

Default: Enabled

Options: Enabled | Disabled

Function: Disables and reenables all differentiated services interfaces on the router.

Instructions: To disable differentiated services on the router, select Disabled. Otherwise, accept the default.

MIB Object ID: 1.3.6.1.4.1.18.3.5.26.1.2

COPS Global Parameters

The Edit COPS Global Parameters window (Figure A-4) contains the COPS client parameters. These are global parameters that apply to the entire router, not just an individual interface. These parameters let you customize how the router communicates with the bandwidth broker.

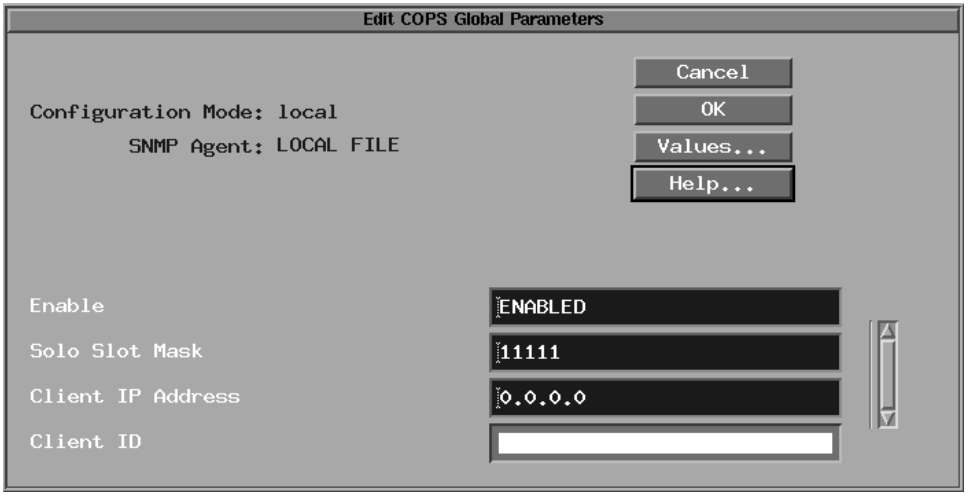

Figure A-4. Edit COPS Global Parameters Window

Parameter: Enable

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Global

Default: Enabled

Options: Enabled | Disabled

Function: Enables and disables COPS on the router.

Instructions: If you selected COPS as the configuration type, this parameter is automatically set to Enabled. To disable COPS without deleting it, select Disabled.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.1.2

Parameter: Solo Slot Mask

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Global

Default: All slots on the router. The number of slots varies by hardware platform.

Options: Hex number representing the slots on the router, up to slot 14.

Function: Specifies the mask for the slot on which the soloist can operate. The most significant bit (MSBit) represents slot 1, the next most significant bit represents slot 2 and so on, up to slot 14.

Instructions: For most cases, accept the default. If you want to change how the router manages its slot resources, change the slot mask by entering a hex value that specifies the slots for the COPS soloist.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.1.6

Parameter: Client IP Address

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Global

Default: None

Options: An IP address of a router interface

Function: Specifies the IP interface address of the COPS client, that is, the router. COPS uses this address to communicate with the bandwidth broker.

Instructions: Enter the IP address of the router as the COPS client.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.1.8

Parameter: Client ID

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Global

Default: None

Options: Any alphanumeric string

Function: Identifies the router to the COPS server by assigning it a unique ID.

Instructions: Specify an ID for the router as the COPS client.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.1.9

COPS Server List Parameters

The COPS Server List window (Figure A-5) contains the list of COPS servers that are allowed to install filters on the router.

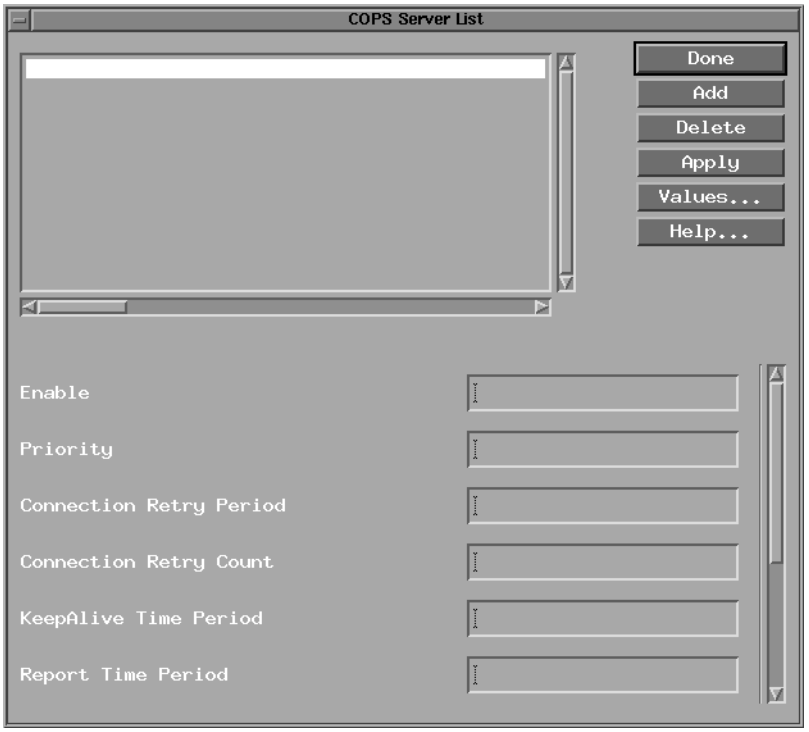

Figure A-5. COPS Server List Window

Parameter: Enable

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: Enabled

Options: Enabled | Disabled

Function: Enables and disables a COPS server.

Instructions: If you selected COPS as the configuration type, this parameter is automatically set to Enabled. To disable a COPS server without deleting it from the server list, select Disabled.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.2

Parameter: Priority

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: 1

Options: 1 to 128

Function: Assigns a priority rating to the COPS server. The higher the number, the higher the priority. For example, a server with a priority of 2 will be the active server before a server with a priority of 1.

Instructions: Enter a priority value for the server.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.4

Parameter: Connection Retry Period

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: 30

Options: 1 to 65535 seconds

Function: Specifies the time period, in seconds, between connection retry attempts to the server.

Instructions: Enter a value for the connection retry interval.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.6

Parameter:	**Connection Retry Count**
Path:	Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers
Default:	3
Options:	1 to 10
Function:	Specifies the number of connection attempts that the router makes before determining that the server is unreachable.
Instructions:	Enter a value for the number of connection retry attempts to the server.
MIB Object ID:	1.3.6.1.4.1.18.3.5.25.1.2.1.7

Parameter:	**KeepAlive Time Period**
Path:	Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers
Default:	1
Options:	1 to 65535 seconds
Function:	Specifies the time period, in seconds, between the transmission of keepalive packets to the server.
Instructions:	Enter a value for the transmission interval between keepalive packets. Note that the router negotiates this value with the server. If the server replies with a value that is different from the value you set, the router uses the server's value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.25.1.2.1.8

Parameter: Report Time Period

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: 360

Options: 1 to 65535 seconds

Function: Specifies the time period, in seconds, between the transmission of statistics reports to the server. The statistics reports provide information for each flow filter.

Instructions: Enter a value for the transmission interval between reports. Note that the router negotiates this value with the server. If the server replies with a value that is different from the value you set, the router uses the server's value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.9

Parameter: TCP KeepAlive Interval

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: 60

Options: 0 to 65535 seconds

Function: Specifies the time period, in seconds, between the transmission of keepalive packets that the router sends across a TCP connection.

Instructions: Enter a value for the transmission interval between TCP keepalive packets. Enter a value of 0 to disable this feature.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.10

Parameter: TCP KeepAlive RTO

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: 60

Options: 0 to 65535 seconds

Function: Specifies the keepalive retransmit timeout (RTO) period, in seconds. This is the interval during which the router sends unacknowledged keepalive packets. If the TCP KeepAlive Interval parameter is set to 0, the router ignores this timer.

If the TCP KeepAlive Interval Timer is set to a nonzero value and this parameter is set to 0, the router does not send keepalive packets. Either side of the connection can then end the session after the TCP KeepAlive Interval expires.

Instructions: Enter a value for the retransmit timeout period.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.11

Parameter: TCP KeepAlive Max Retry Cnt

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers

Default: 4

Options: 0 to 65535

Function: Specifies the number of unacknowledged keepalive packets retransmitted before the TCP session is terminated. If this value is set to 0, the router only sends one keepalive packet.

Instructions: Enter a number for the maximum number of unacknowledged keepalive packets the router should send.

MIB Object ID: 1.3.6.1.4.1.18.3.5.25.1.2.1.12

Parameter:	**Remote TCP Port**
Path:	Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers
Default:	3288
Options:	1 to 65535
Function:	Specifies the remote TCP port of the COPS server.
Instructions:	In most cases, accept the default TCP port, 3288. If the bandwidth broker application operates on a port that is different from the default, specify a different port.
MIB Object ID:	1.3.6.1.4.1.18.3.5.25.1.2.1.13

COPS Server Record Parameters

The COPS Server Record window (Figure A-6) contains the parameters that tell the router how to communicate with the COPS servers. With the exception of the IP Address parameter, described on page A-16, the parameters in this window are the same as those in the COPS Server List window (see Figure A-5 on page A-9).

See "COPS Server List Parameters" beginning on page A-9 for parameter descriptions.

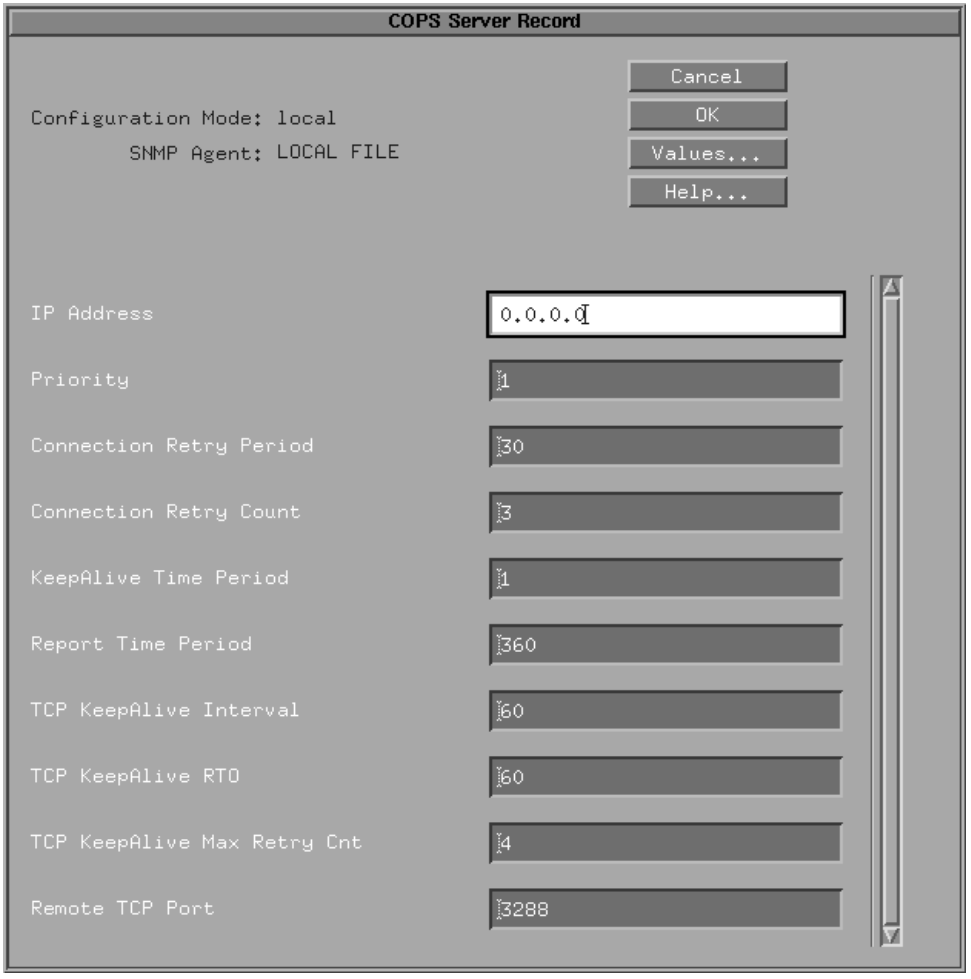

Figure A-6. COPS Server Record Window

Parameter: **IP Address**

Path: Configuration Manager > Protocols > Global Protocols > COPS Client > COPS Servers > **Add**

Default: None

Options: A valid IP address

Function: Identifies the COPS server.

Instructions: Enter the IP address of the COPS server.

MIB Object ID: Not applicable

Static Traffic Filter Parameters

When you click on the Traffic Filt button in the DiffServ Interface List window (see Figure A-1 on page A-2), the DiffServ Static Filters window (Figure A-7) opens. From this window, you can configure traffic filters.

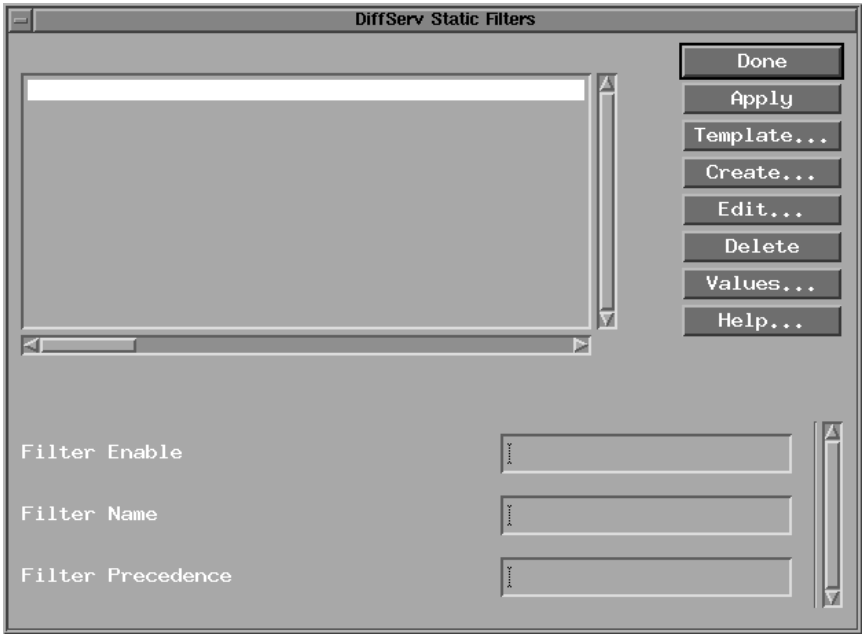

Figure A-7. DiffServ Static Filters Window

When you click on Template in the DiffServ Static Filters window (Figure A-7), and then click on Create, the Create DiffServ Template window opens (Figure A-8).

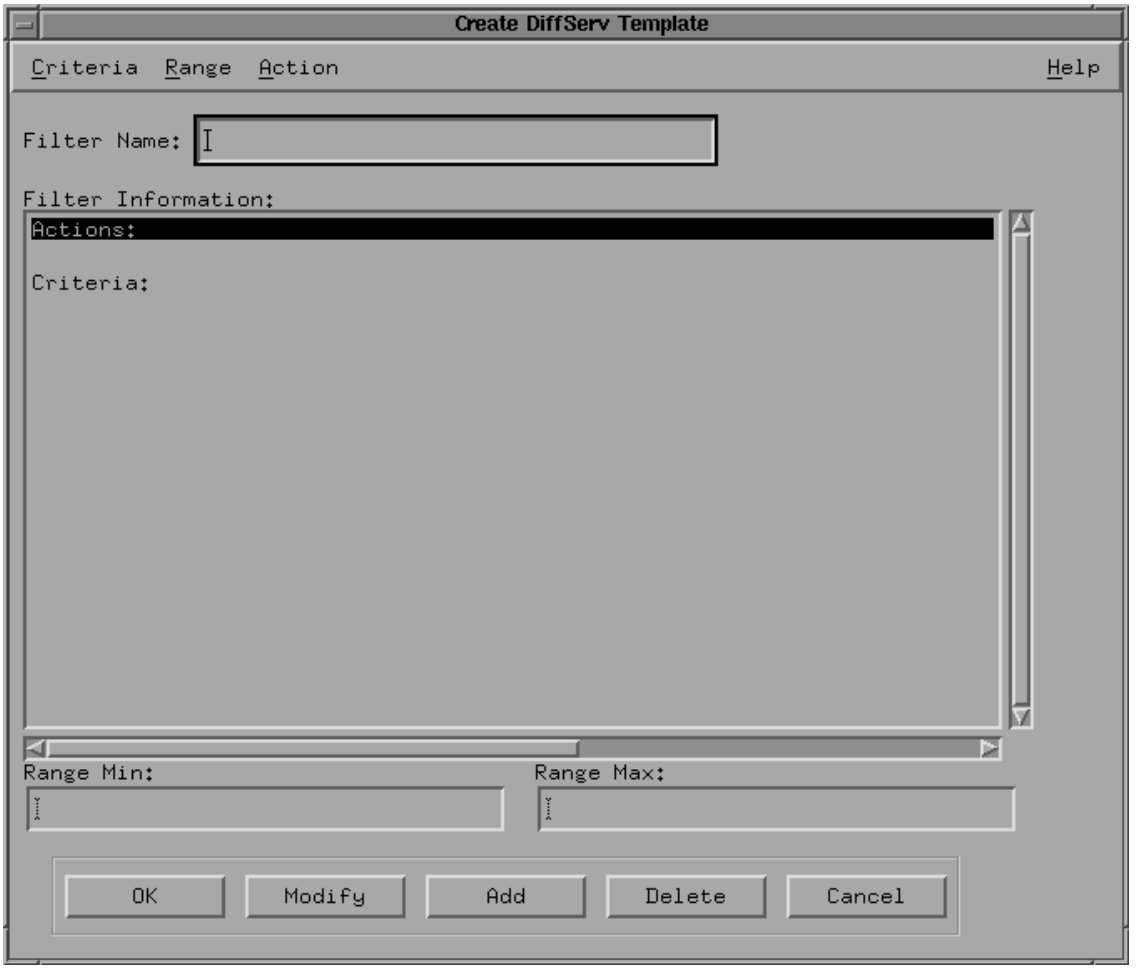

Figure A-8. Create DiffServ Template Window

From this window, you can configure filter criteria and actions.

There are many criteria you can add to a filter. For more information about filters, see *Configuring Traffic Filters and Protocol Prioritization*.

For the filter criteria, the URL string criterion is unique to differentiated services.

For the filter criteria, you can add the following actions:

- Log
- Drop
- Accept
- Set DS Field
- Set DS Police

Note: Log is the only action that you can combine with other actions. For example, you cannot combine Drop and Set DS Field.

DS Field

If you add the action Set DS Field, the DS Field window opens (Figure A-9). The DS field specifies the marking of the DS field in the IP packet header. The range can be 00000000 to 11111111, which is 0 to 255 expressed in binary form.

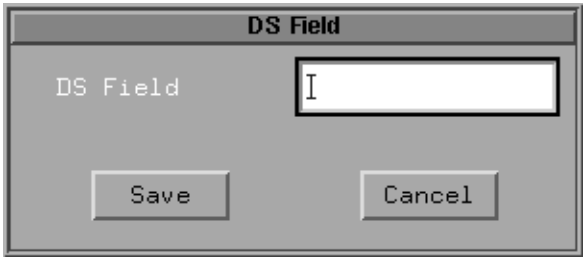

Figure A-9. DS Field Window

RFC 2474 defines specific guidelines for configuring the DS field. Six bits of the DS field are used to select the per-hop behavior of a packet as it travels through each node. The last two bits of the field are currently unused. The value of these two bits are ignored by differentiated services-compliant nodes when determining the per-hop behavior to apply to a packet.

DS Police Parameters

To configure static traffic filters that “police” the data flow, set the DS Police action for the filter and then configure the parameters in the DS Police window (Figure A-10).

Figure A-10. DS Police Window

Parameter: Token Bucket Rate (Kbps)

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: None

Options: Any integer

Function: Sets the rate at which the router accepts data. Specifying the data rate can prevent the host from sending too much data to the router.

Instructions: Enter a value for the data rate.

MIB Object ID: Not applicable

Parameter: Token Bucket Size (Bits)

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: None

Options: Any integer

Function: Determines the burst size of data that the router accepts. This parameter enables the router to guard against large bursts of data; it balances the flow of data.

Instructions: Enter a value for the bucket size.

MIB Object ID: Not applicable

Parameter: MIN Policed (Bytes)

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: 20

Options: Any integer

Function: Specifies the minimum packet size that the router allows for the network. If the packet size is smaller than the value set for this parameter, the router uses this parameter value as the packet size. If the packet size is larger than this parameter, the router uses the packet's actual size.

Instructions: Enter a value for the minimum packet size that the router should police.

MIB Object ID: Not applicable

Parameter: **MAX Policed (Bytes)**

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: 0xffffffff

Options: 0 to 0xffffffff

Function: Specifies the maximum packet size that the router allows for the network. This parameter lets the router prevent large packets from being admitted into the network.

Instructions: Enter a value for the maximum policed packet size. If the packet size is larger than this value, the router considers the data beyond the flow filter profile. In this case, the router refers to the Out of Profile Behavior and Out of Profile Marking parameters to determine how to treat the packet.

MIB Object ID: Not applicable

Parameter: **Inprofile Marking**

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: 00000000

Options: 00000000 to 11111111

Function: Specifies what the DS byte is set to if the policing algorithm accepts the packet. The value represents the type of service that the packet receives.

Instructions: Enter the value that the router should use to mark the packet.

MIB Object ID: Not applicable

Parameter: **Inprofile Behavior**

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: Mark

Options: Mark | No Change

Function: Tells the router how to treat packets that are within the filter profile.

Instructions: If you want the packet to be marked according to the value in the Inprofile Marking parameter, accept the default, Mark. If not, select No Change.

MIB Object ID: Not applicable

Parameter: **Out of Profile Marking**

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: 00000000

Options: 00000000 to 11111111

Function: If the packet size does not fit the filter profile, for example, the host is sending more data than it should, this parameter tells the router how to mark the packet.

Instructions: Enter the value that the router should use to mark the packet.

MIB Object ID: Not applicable

Parameter: **Out of Profile Behavior**

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Action > Add > DiffServ Set Police

Default: No Change

Options: No Change | Mark | Drop

Function: Tells the router how to treat the packet if it does not fit the filter profile.

Instructions: If you want the packet to be marked according to the value in the Out of Profile Marking parameter, select Mark. If you want the router to drop the packet, select Drop. Otherwise, accept the default, No Change.

MIB Object ID: Not applicable

HTTP Filter Parameter

You can filter packets based on URL strings. To do this, you need to specify the URL using the following parameters in the Add URL window (Figure A-11).

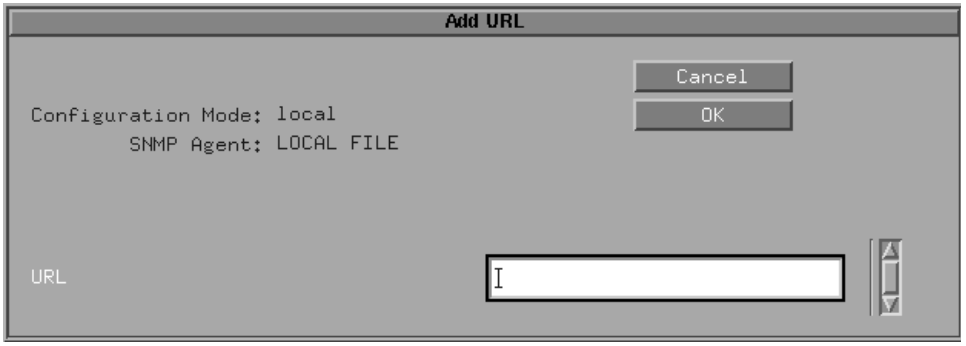

Figure A-11. Add URL Window

Parameter: URL

Path: Configuration Manager > Protocols > IP > DiffServ > Interfaces > **Traffic Filt** > **Template** > **Create** > Criteria > Add > Add URL

Default: None

Options: A URL for an HTTP host, up to a maximum of 128 characters.

Function: Specifies the particular URL that the router should use as a filter criterion. If the router receives a packet with this URL, the router filters the packet.

Instructions: Specify a URL for the filter, for example, *www.website.com*. You do not have to enter *http://* before the URL; the router fills that in automatically.

MIB Object ID: Not applicable

Appendix B
Configuration Examples

This chapter contains the following configuration examples:

Topic	Page
A Differentiated Services Network Using Dynamic Filters	B-1
A Differentiated Services Network Using Static Traffic Filters	B-6

A Differentiated Services Network Using Dynamic Filters

In this configuration example, a local news station needs to download a video tape from the main news office's video server. This video contains critical pictures for a news story, so the video data needs to be given priority over other data.

Figure B-1 shows the differentiated services network.

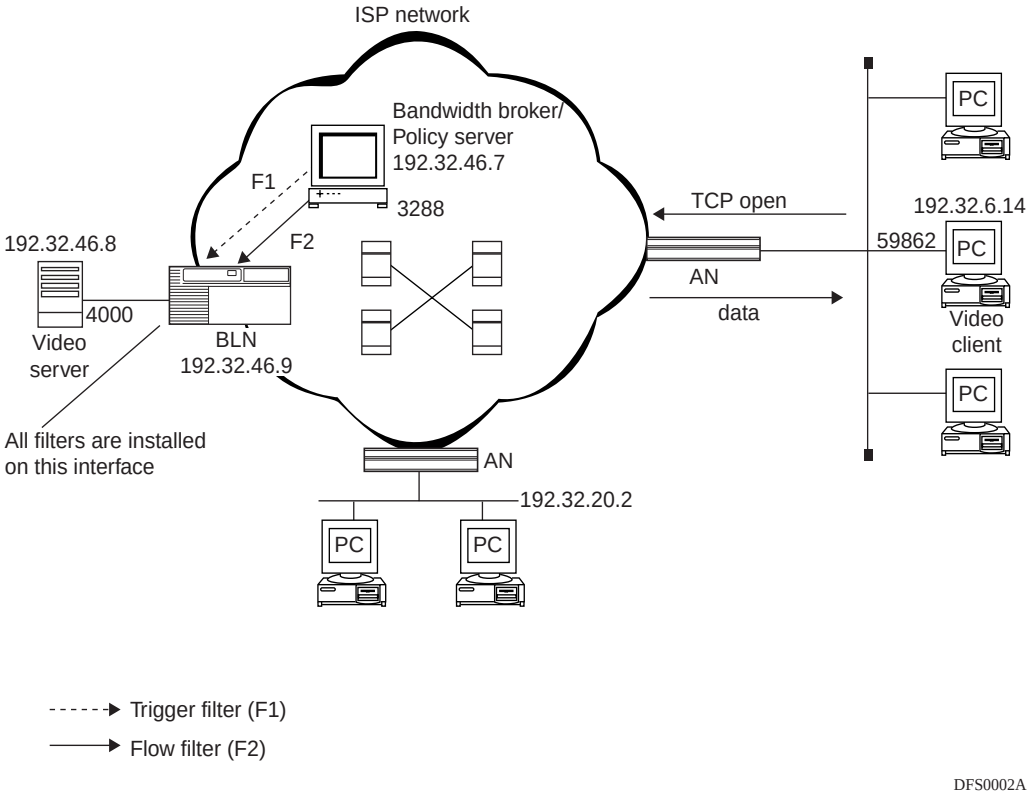

Figure B-1. Differentiated Services Network

Prior to any data being transmitted, the system administrator for the policy server needs to create a policy. This policy generates a trigger filter and a flow filter that the bandwidth broker installs on the BLN® router.

Table B-1 on page B-3 shows the two filters installed on the BLN router.

Table B-1. Filters on the BLN Router

Criteria	Trigger Filter (F1)	Flow Filter (F2)
IP source address	192.32.46.8	192.32.46.8
IP destination address	192.32.6.0 -- 192.32.6.255	192.32.6.14
TCP source port	4000	4000
TCP destination port	unspecified	59862
Police action	trigger	2 MB/s
Idle time	N/A	2 minutes
Mark	N/A	01000000

The sequence of events in this network is as follows:

1. When the router activates, it connects to the bandwidth broker. The bandwidth broker automatically installs the trigger filter (F1) on the router.
2. The remote video client establishes a TCP connection to the video server and requests the video data.
3. The video server begins sending the data to the client. The first packet that the server sends reaches the BLN router. The router matches the packet to the trigger filter criteria and then sends a trigger filter event message to the bandwidth broker. This event message includes the first packet sent by the video server.
4. After the bandwidth broker receives the trigger packet, it installs the flow filter (F2) on the BLN router.
5. The router looks at each packet that it receives and marks the video packets according to the configuration of the flow filter (F2).

Note: Prior to the router receiving the flow filter, some of the initial packets sent by the video server are not marked; they are simply sent on a best-effort basis. However, these initial packets are often control packets and not actual data.

6. When the core devices in the network receive the marked packets, they look at the DS field, interpret the marked packet, and give the video data priority over other data, sending the data to the remote video client.

7. After all the data is sent, the BLN router waits for 2 minutes, which in this example is the idle time, and then removes the flow filter. It then sends a message to the bandwidth broker indicating that the flow filter has been removed.

Configuring the Router

The router's configuration for the differentiated services network in Figure B-1 is shown in the following sections.

These tables provide instructions on how to access the appropriate Site Manager windows and configure specific parameters. Only those parameters that you must change from the default value are listed. If a parameter is not included, it means that you can accept the default value.

Configure a Differentiated Services Interface

First, configure a differentiated services interface and enable COPS, as follows:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on an IP interface connector.	The Add Circuit window opens.
2. Accept the default circuit name or enter a new name, then click on **OK**.	The Select Protocols window opens.
3. Scroll through the list of protocols and choose **DiffServ**, then click on **OK**.	The IP Configuration window opens.
4. Enter **192.32.46.9** in the **IP Address** parameter, then click on **OK**.	The DiffServ Interface List window opens. The interface is now enabled.
5. Set the **Config Type** parameter to **COPS**.	Site Manager displays a message informing you that the static filters will be deleted and asks if you want to continue.
6. Click on **OK**.	You return to the DiffServ Interface List window.
7. Click on **Done**.	You return to the Configuration Manager window.

Configure COPS

To enable COPS for the interface, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the DiffServ Interface List window Click on **COPS Global**.	The Edit COPS Global Parameters window opens.
2. Set the **Client IP Address** parameter to **192.32.46.9** and the **Client ID** parameter to **corp1**.	
3. Click on **OK**.	You return to the DiffServ Interface List window.
4. Click on **COPS Servers**.	The COPS Server List window opens.
5. Click on **Add**.	The COPS Server Record window opens.
6. Set the COPS server's **IP Address** parameter to **192.32.46.7**.	
7. Click on **OK**.	You return to the COPS Server List window. Site Manager displays the COPS server entry in the scroll list.
8. Click on **Done**.	You return to the DiffServ Interface List.
9. Click on **Done**.	You return to the Configuration Manager window.

The router can now operate as a differentiated services edge device, marking the video data packets for priority service through the network.

A Differentiated Services Network Using Static Traffic Filters

In this configuration example, a corporate enterprise network connects employes to corporate information, such as benefits forms. The employees need to download forms, which are HTTP pages, from a server. When a client requests a form, this request and data should receive a higher priority than other requests, so differentiated services is implemented.

In this network, instead of using filters configured on a policy server, filters are configured statically on the router.

To implement differentiated services in this network, you must configure two interfaces on the router. One interface sends data to the clients and the other sends requests and control packets locally to the server. Two interfaces are needed because the router can implement only inbound filtering for differentiated services, which means that the router filters only packets that it receives, not those it sends.

Figure B-2 shows the differentiated services network.

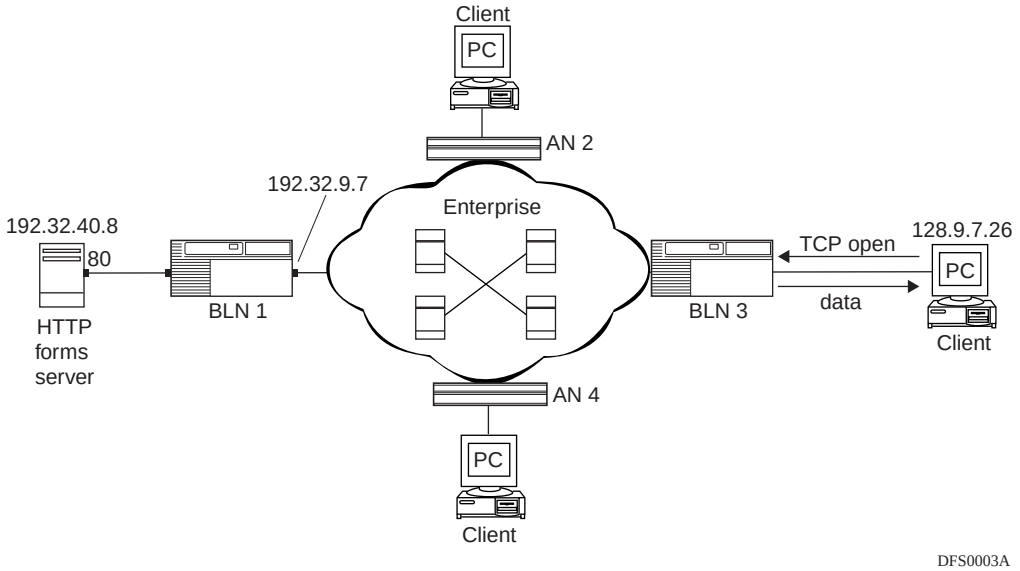

Figure B-2. Differentiated Services Network Using Static Filters

Configuring the Router

For the network in Figure B-2, you must configure a static traffic filter on the router.

The tables provide instructions on how to access the appropriate Site Manager windows and configure the specific filter parameters. Only those parameters that you must change from the default value are listed. If a parameter is not included, it means that you can accept the default value.

The traffic filter that you need to configure uses the DS police action. After you configure the DS police action, the router will know how to mark packets for transmission through the network to the client.

Configure a Differentiated Services Interface

To configure a differentiated services interface on BLN 1, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the Configuration Manager window, click on an IP interface connector.	The Add Circuit window opens.
2. Accept the default circuit name or enter a new name, then click on **OK**.	The Select Protocols window opens.
3. Scroll through the list of protocols and choose **DiffServ**, then click on **OK**.	The IP Configuration window opens.
4. Enter **192.32.9.7** in the **IP Address** parameter, then click on **OK**.	The DiffServ Interface List window opens. The interface is now enabled.
5. Click on **OK**.	You return to the DiffServ Interface List window.
6. Keep the DiffServ Interface List window open and go to the next section.	

Configure a Static Filter

To configure a filter template that includes the DS police action, complete the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the DiffServ Interface List window, select the interface you want to modify and click on **Traffic Filt**.	The DiffServ Static Filters window opens.
2. Click on **Template**.	The Filter Template Management window opens.
3. Click on **Create**.	The Create DiffServ Template window opens.
4. Enter **httpfilter** in the **Filter Name** field.	
5. Choose **Criteria**.	The Criteria window opens.
6. Choose **Add** and add the following criteria: • **IP Source Address**: 128.9.7.0 to 128.9.7.255 • **IP Destination Address:** 192.32.40.8 • **TCP frame**: **TCP Source Port**: unspecified **TCP Destination Port**: 80 • **Add URL**: URL: www.hradmin.com	
7. Choose **Action**.	The Action menu opens.
8. Choose **Add**.	The Add menu opens.
9. To filter using the DiffServ Police, choose **DiffServ Set Police** and set the following parameters: • **Token Bucket Rate (Kbps) = 5 MB/s** • **Token Bucket Size (Bits) = 1600** • **Inprofile Marking = 00100000**	
10. Click on **Save**.	You return to the Create DiffServ Template window.
11. Click on **OK.**	You return to the Filter Template Management window.
12. Click on **Done**.	You return to the DiffServ Static Filters window.

Apply the template you just created by completing the following tasks:

Site Manager Procedure	
You do this	**System responds**
1. In the DiffServ Static Filters window, click on **Create**.	The Create Filter window opens.
2. Enter **corpforms** in the **Filter Name** field.	
3. Select the differentiated services interface **192.32.9.7** in the Interfaces list.	
4. Select **httpfilter** in the Templates list.	
5. Click on **OK.**	You return to the DiffServ Static Filters window. Site Manager displays the filter name and its interface in the scroll list.
6. Click on **Done** until you return to the Configuration Manager window.	

Once the router marks the packet, this packet receives preferential treatment from the core devices in the network and sends them along to the client.

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